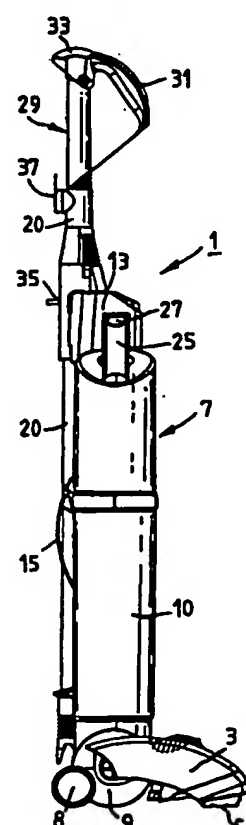


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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup>:</b> <b>A47L 5/28</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 99/30604</b> <b>(43) International Publication Date:</b> 24 June 1999 (24.06.99)
<b>(21) International Application Number:</b> PCT/GB98/03813 <b>(22) International Filing Date:</b> 17 December 1998 (17.12.98) <b>(30) Priority Data:</b> 9726673.8 17 December 1997 (17.12.97) GB <b>(71) Applicant (for all designated States except US):</b> NOTETRY LIMITED [GB/GB]; Kingsmead Mill, Little Somerford, Wiltshire SN15 5JN (GB). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> DYSON, James [GB/GB]; Kingsmead Mill, Little Somerford, Wiltshire SN15 5JN (GB). <b>(74) Agent:</b> DEVONS, David, Jon; Marks & Clerk, 57-60 Lincoln's Inn Fields, London WC2A 3LS (GB).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
<b>(54) Title:</b> A VACUUM CLEANER  <b>(57) Abstract</b> <p>The present invention relates to a vacuum cleaner (1) comprising a first casing (10) housing dust separation apparatus, a second casing (11) housing at least one filter (21, 23) or other component of the vacuum cleaner (1), a central spine (13) housing at least one conduit and forming part of an airflow path within the vacuum cleaner (1), the first and second casings (10, 11) lying generally parallel to one another and the central spine (13) lying at least partly between the first and second casings (10, 11). Such a construction provides a vacuum cleaner having a more compact profile which enables the vacuum cleaner to be used to clean areas where there is a height restriction, for example underneath furniture.</p> 		

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### A Vacuum Cleaner

The present invention relates to a vacuum cleaner.

An upright vacuum cleaner generally has a cleaner head rotatably mounted to the lower end of a main body in which dust separation apparatus is housed. A pair of wheels are mounted on the lower end of the main body or on the cleaner head. The cleaner head extends in a forward direction. A dirty air inlet is located at the forward end of the cleaner head and facing downwardly so that, in use, the dirty air inlet rests on the surface to be cleaned. Dirty air is sucked into the dust separation apparatus via the dirty air inlet by means of a fan driven by a motor.

Upright vacuum cleaners are commonly convertible into cylinder cleaners. In the cylinder mode, a wand or hose attached to the vacuum cleaner is used to provide the dirty air inlet instead of the dirty air inlet located in the cleaner head. This mode enables cleaning of confined areas which can not be easily reached by the cleaner head, for example, stairs, underneath furniture etc.

Such conventional vacuum cleaners are bulky and therefore it is not possible to use the vacuum cleaner in its upright mode to clean some surfaces which are awkward to reach, in particular areas having a height restriction, for example under pieces of furniture such as beds, sofas and chairs. Therefore, to clean these areas it is necessary either to move the piece of furniture, which can be very difficult for large pieces of furniture, or to use the vacuum cleaner in its cylinder cleaning mode, which can be awkward, inconvenient and time consuming. Also, as these cleaners are so bulky they take up considerable storage space which makes storing the vacuum cleaner, when not in use, difficult or awkward.

The present invention seeks to provide a vacuum cleaner which is less bulky in order to overcome the above disadvantages.

According to the present invention there is provided a vacuum cleaner comprising a first casing housing a dust separation apparatus, a second casing housing at least one filter or other component of the vacuum cleaner, and a central spine housing at least one conduit forming part of an air flow path within the vacuum cleaner, the first and second casings lying generally parallel to one another and the central spine lying at least partly between the first and second casings.

In providing a vacuum cleaner having a central spine which lies partly between separate casing which house the dust separation apparatus and at least one filter or other component, the overall size (ie. depth) of the cleaner can be minimised. Therefore, the vacuum cleaner can be used to clean areas having a much lower height restriction as the reduced depth of the cleaner enables it to slide underneath furniture etc. Also the vacuum cleaner is more compact making it less cumbersome to manoeuvre or carry and easier to store.

To further minimise the size of the vacuum cleaner, the central spine may lie wholly between the first and second casings.

The casings may be generally cylindrical in shape and arranged such that the longitudinal axis of each casing lies parallel to the longitudinal axis of the central spine. This helps to further reduce the size of the vacuum cleaner.

Further, the vacuum cleaner may comprise a cleaner head in which an inlet for dirty air is located, the cleaner head being rotatable with respect to the central spine and the first and second casings, wherein the depth of each casing is approximately equal to the height of the cleaner head, or wherein the depth of each casing is no greater than the height of the cleaner head. Therefore, when the central spine is tilted rearwardly so that the central spine, casings and cleaner head are almost horizontal, the height of the casings would be approximately the same as, or at least no greater than, the height of the cleaner head. In this horizontal position, the overall height of the vacuum cleaner is minimised and the vacuum cleaner can be used to clean areas where there is a height restriction, for example underneath beds.

In a preferred embodiment, the vacuum cleaner comprises a conduit for transferring dirty air from an inlet for dirty air into the dust separation apparatus and a conduit for transferring dirty air from the dust separation apparatus to a pre-motor filter housed in the second casing. This means that the air flow path within the vacuum cleaner is integral with the central spine further reducing the size of the cleaner.

To aid maintenance, cleaning and replacement of the dust separation apparatus or filters, the casings may be releasably attached to the central spine.

Preferably, the dust separation apparatus is a cyclonic separator, more preferably a dual cyclonic separator. Preferably, the second casing houses a pre-motor and a post-motor filter which may be stacked coaxially on top of one another.

An embodiment of the invention will now be described and fully explained with reference to the accompanying drawings, wherein:

Figure 1 is a side view of a vacuum cleaner according to the present invention;

Figure 2 is a front view of the vacuum cleaner of Figure 1; and

Figure 3 shows the detail of the release mechanism of the casings of the vacuum cleaner of Figure 1; and

Figure 4 shows the internal detail and air flow path of the vacuum cleaner of Figure 1.

With reference to the Figures 1 to 3, the vacuum cleaner 1 of the present invention comprises a cleaner head 3 having a downwardly directing dirty air inlet 5 at its forward end. The cleaner head 3 extends in a forward direction and is rotatably attached to the lower end of the main body 7 of the vacuum cleaner 1 via a motor housing 9. The motor housing 9 is generally cylindrical and extends across the width of the cleaner head 3. A pair of wheels 8 are mounted onto the motor housing 9 at the rear of the vacuum cleaner 1.

The main body 7 comprises a first casing 10 and a second casing 11 releasably attached to a central spine 13. The first and second casings 10, 11 are generally cylindrical. The longitudinal axis of each casing lies parallel to the longitudinal axis of the central spine 13. The central spine 13 lies wholly between the first and second casings 10, 11.

The casings 10,11 and the central spine 13 are fixed onto the motor housing 9 so that the longitudinal axis of the motor housing 9 is perpendicular to the longitudinal axis of the central spine 13 and the first and second casings 10,11. The first and second casings 10,11 are supported on either side of the central spine 13 so that the casings 10,11 and the central spine 13 are in alignment along the length motor housing 9. The base of each casing 10,11 fits into a complimentary recess 14 of the motor housing 9. The diameter of each of the casings 10,11 is approximately equal to the diameter of the motor housing 9 and is approximately equal to, or at least no greater than, the height of the cleaner head 3.

A wand 20 is releasably attached to the rear of the central spine 13 of the vacuum cleaner 1. The wand 20 comprises a generally straight hollow tube. It is detached from the central spine and used as the dirty air inlet when the cleaner is used in its cylinder cleaning mode as in known cleaners.

The first casing 10 houses dust separation apparatus, for example a dual cyclonic separator (not shown). The first casing 10 has a handle 15 extending outwardly from the rear of the main body of the vacuum cleaner to facilitate removal for emptying purposes.

The second casing 11 houses a pre-motor filter 23 stacked coaxially on top of a post-motor filter 21. The upper portion of the second casing 11 comprises an accessory tool holder 17 for holding accessory tools 19 for attachment to the wand 20 of the vacuum cleaner 1 for use as the dirty air inlet in the cylinder cleaning mode.

The first casing 10 has an upwardly extending curved handle 25. The upper end of the handle 25 is releasably attached to the central spine 13 by a release mechanism 27 which may be a push-catch. The casing 10 can be released from the vacuum cleaner by pushing the catch 27 in the direction of the arrow X shown in Figure 3. The casing 10 can then be pulled away from the central spine 13 in the directions of the arrow Y shown in Figure 2 and lifted out of the recesses 14 of the motor housing 9. The second casing 11 can be made accessible by similar or alternative fastening means. The second casing has a handle 25' for aesthetic purposes and which can also function as a handle for lifting the vacuum cleaner off the floor if necessary.

The central spine 13 comprises a conduit 36 for transferring dirty air from the dirty air inlet 5 into the dust separation apparatus housed within the first housing 10 and a conduit for transferring dirty air from the dust separation apparatus into the second casing 11 housing the filters 21,23. Details of this are illustrated in Figure 4. The dirty air flows in the direction of the arrows Z indicated in Figure 4. The dirty air flows through the cleaner head 3 and enters the base of the conduit 36 of the central spine 13 via the inlet 37. The dirty air then flows upwards towards an outlet 39 at the top of the conduit and into the separator, in this case a dual cyclonic separator, housed in the first casing 10. Particles within the dirty air are separated by the cyclonic separator. The cleaned air flows out of the separator via an outlet 41 and then passes through the pre-motor filter 23 and the post-motor filter 21 via the inlets 43, 45 and 47 before exiting to the atmosphere. The airflow is also used to cool the motor before passing through the post-motor filter 21.

The wand 20 extends upwardly from the central spine 13 and the casings 10,11. The upper portion of the wand 20 forms a handle 29 having a gripping portion 31 extending forwardly and downwardly from the upper end of the wand 20. The open, upper end of the wand 20 is sealed by a cap 33 which is movable between a closed and open position. The cap 33 extends in a rearward direction to form a hook integral with the cap 33 so that the cleaner can be hung up on a wall.

The power supply for the motor housed in the motor housing 9 is provided via a cable which enters the central spine at a point 35 just above the handle 25 of the first casing 10. The cable extends down the central spine 13 to the motor housing 9 for electrical connection to the motor. The external part of the cable (not shown) is wrapped in a loop at the rear of the vacuum cleaner via a hook 37 fitted on the wand 20 when not in use.

In use, the user grasps the gripping portion 31 of the handle 29 and tilts the main body 7 of the vacuum cleaner 1 towards himself so that the cleaner head 3 extends in a forward direction. The vacuum cleaner is moved across the surface to be cleaned and dirty air is sucked up through the dirty air inlet 5 into the cleaner head 3 and then into

the dust separation apparatus housed in the first casing 10 by means of a fan driven by the motor.

Due to the reduced profile of the vacuum cleaner, it can be used into areas where there is a height restriction, for example underneath furniture. The vacuum cleaner is arranged so that the main body 7 can be tilted rearwardly so that the main body 7 and the cleaner head 3 are horizontal. In order to minimise the overall height of the vacuum cleaner 1 the diameter of the casings 10 and 11 is such that it is approximately equal to the height of the cleaner head 3, or at least no greater than the height of the cleaner head. The clearance height of the vacuum cleaner is preferably around 140mm.

The motor housing 9 is constructed to have minimal dimensions and is such that its diameter is approximately equal to the diameter of the first and second casings 10 and 11. The pair of wheels 8 at the rear of the vacuum cleaner 1 are also minimised in size. This helps to reduce the overall size of the vacuum cleaner and to reduce its weight to make it more compact.

In the light of this disclosure, modifications of the described embodiment as well as other embodiments within the scope of the appended claims will now become apparent to a person skilled in the art.



**CLAIMS:**

1. A vacuum cleaner comprising a first casing housing dust separation apparatus, a second casing housing at least one filter or other component of the vacuum cleaner, and a central spine housing at least one conduit forming part of an airflow path within the vacuum cleaner, the first and second casings lying generally parallel to one another and the central spine lying at least partly between the first and second casings.
2. A vacuum cleaner according to claim 1, wherein the central spine lies wholly between the first and second casings.
3. A vacuum cleaner according to claim 1 or 2, wherein each casing is generally cylindrical, the longitudinal axis of each casing lying parallel to the longitudinal axis of the central spine.
4. A vacuum cleaner according to any one of the preceding claims, wherein the vacuum cleaner further comprises a cleaner head in which an inlet for dirty air is located, the cleaner head being rotatable with respect to the first and second casings and the central spine, and wherein the depth of each casing is approximately equal to the height of the cleaner head.
5. A vacuum cleaner according to any one of claims 1 to 3, wherein the vacuum cleaner comprises a cleaner head in which an inlet for dirty air is located, the cleaner head being rotatable with respect to the first and second casings and the central spine, and wherein the depth of each casing is no greater than the height of the cleaner head.
6. A vacuum cleaner according to any one of the preceding claims, wherein the second casing houses a pre-motor filter.

7. A vacuum cleaner according to claim 6, wherein the central spine comprises a conduit for transferring dirty air from an inlet for dirty air into the dust separation apparatus and a conduit for transferring dirty air from the dust separation apparatus to the pre-motor filter.
8. A vacuum cleaner according to any one of the preceding claims, wherein at least one of the casings is releasably attached to the central spine.
9. A vacuum cleaner according to claim 8, wherein the first and second casings are releasably attached to the central spine.
10. A vacuum cleaner according to any one of the preceding claims, wherein the dust separation apparatus is a cyclonic separator.
11. A vacuum cleaner according to claim 10, wherein the separator is a dual cyclonic separator.
12. A vacuum cleaner according to any one of the preceding claims, wherein the second casing houses a pre-motor filter and a post-motor filter.
13. A vacuum cleaner according to claim 12, wherein the pre-motor filter and the post-motor filter are stacked coaxially on top of one another.
14. A vacuum cleaner as hereinbefore described with reference to the accompanying drawings.

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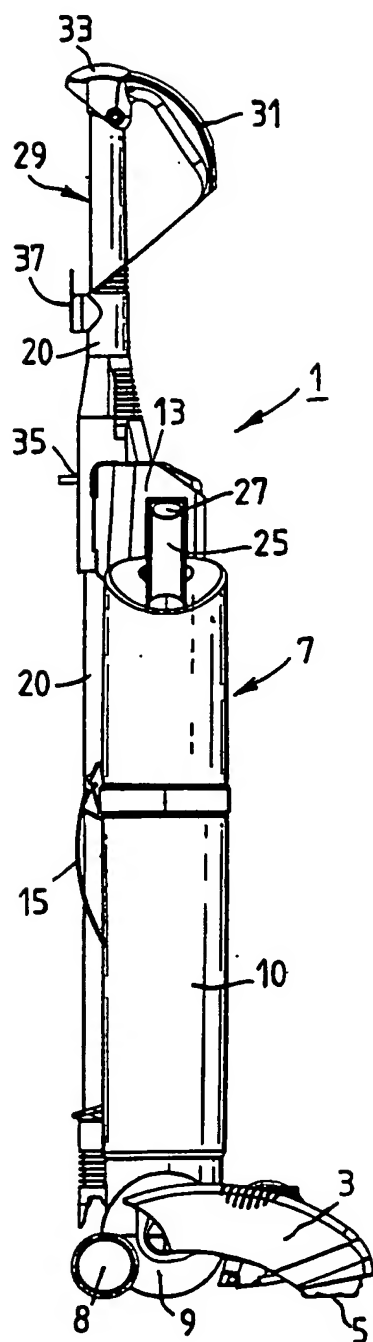


Fig. 1

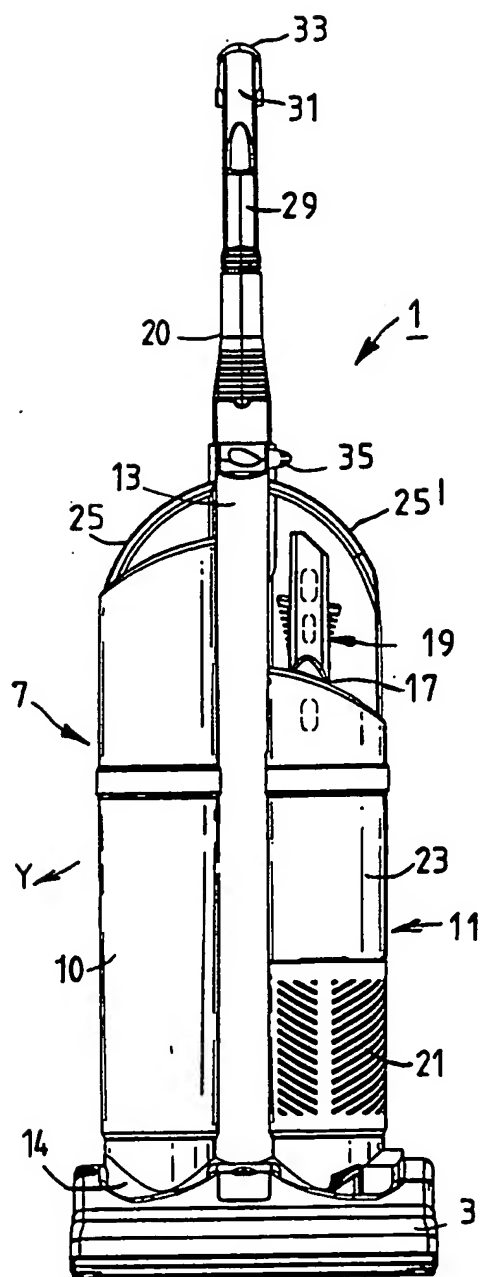


Fig. 2

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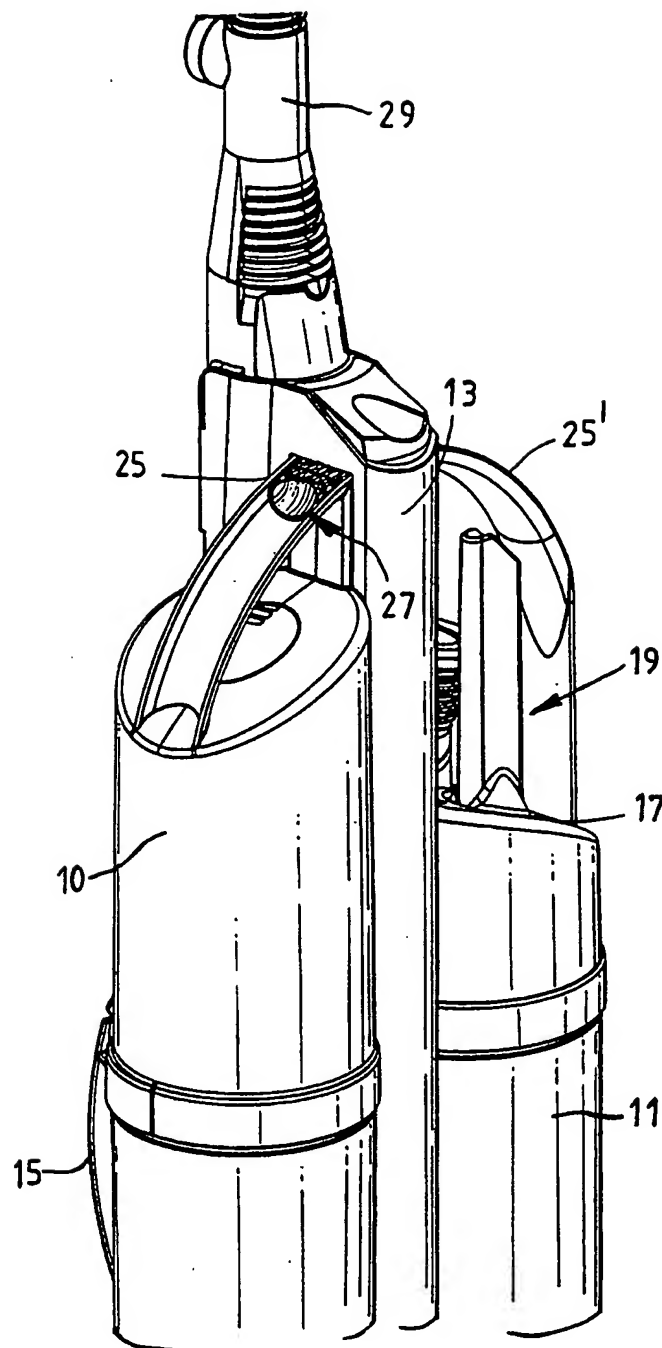


Fig. 3

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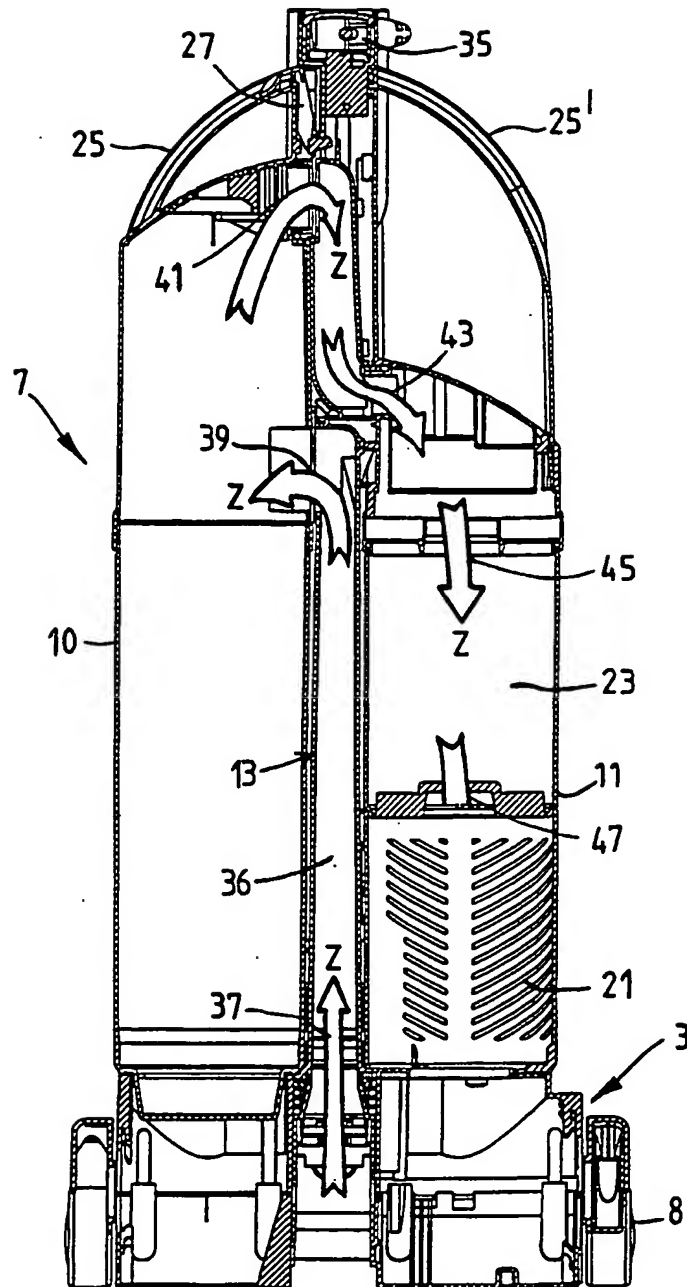


Fig. 4

# INTERNATIONAL SEARCH REPORT

Inte. .onal Application No  
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**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 A47L5/28

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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 373 228 A (DYSON JAMES) 15 February 1983 see column 2, line 23 - line 41 see column 2, line 59 - column 3, line 46 see column 4, line 17 - line 44 see figures 1-5 ----	1
A	PATENT ABSTRACTS OF JAPAN vol. 095, no. 002, 31 March 1995 -& JP 06 311946 A (SANYO ELECTRIC CO LTD), 8 November 1994 see abstract; figures ----- -/--	

☒ Further documents are listed in the continuation of box C.

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DE 30 17 209 A (PROGRESS-ELEKTROGERÄTE  MAUZ &amp; PFEIFFER GMBH &amp; CO)  12 November 1981  see page 6, paragraph 2 - page 7,  paragraph 3  see claim 1; figures  -----</p>	

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4373228 A	15-02-1983	CA 1159610 A EP 0018197 A JP 1056772 B JP 1582142 C JP 55141227 A	03-01-1984 29-10-1980 01-12-1989 11-10-1990 05-11-1980
DE 3017209 A	12-11-1981	NONE	